Behaviour Research and Therapy 47 (2009) 231–236

Contents lists available at ScienceDirect

Behaviour Research and Therapy

journal homepage: www.elsevier.com/locate/brat

The clock as a focus of selective attention in those with primary insomnia: An experimental study using a modified Posner paradigm

H. Woods [a,b,*], L.M. Marchetti [a,b], S.M. Biello [a], C.A. Espie [b]

[a] Department of Psychology, University of Glasgow, Glasgow, UK
[b] Glasgow Sleep Centre, Faculty of Medicine, University of Glasgow, Glasgow, UK

ARTICLE INFO

Article history:
Received 8 August 2008
Received in revised form
4 November 2008
Accepted 16 December 2008

Keywords:
Attention bias
Insomnia
Cognitive arousal
Monitoring
Posner paradigm

ABSTRACT

Espie and colleagues [(2006). The attention–intention–effort pathway in the development of psychophysiological insomnia: a theoretical review. Sleep Medicine Reviews, 10, 215–245] propose a route into psychophysiological insomnia along the attention–intention–effort pathway which focuses on the inhibition of sleep-wake automaticity. A contributing factor to this is selective attention to sleep (alongside explicit intention to sleep and effort in the sleep engagement process). Following on from previous work on selective attention to sleep [Marchetti, L. M., Biello, S. M., Broomfield, N. M., MacMahon, K. M. A., & Espie, C. A. (2006). Who is pre-occupied with sleep?. A comparison of attention bias in people with psychphysiological insomnia, delayed sleep phase syndrome and good sleepers using the induced change blindness paradigm. *Journal of Sleep Research, 15*, 212–221; MacMahon, K., Broomfield, N., Macphee, L., & Espie, C. A. (2006). Attention bias for sleep related stimuli in primary insomnia and delayed sleep phase syndrome using the dot-probe task. *Sleep, 29*, 11] and considering the importance of monitoring both internal and external cues in the maintenance of insomnia, as highlighted in the cognitive model of insomnia [Harvey, A. G. (2002). A cognitive model of insomnia. *Behaviour Research and Therapy, 40*, 869–893], a cognitive probe task was employed to investigate further the role of the clock as a focus of selective attention in those with primary insomnia.

A 2×2 between participants design comparing reaction time of individuals with primary insomnia ($n = 22$) and normal sleepers ($n = 22$) on a modified Posner paradigm. Responses obtained from a computer task presenting times which fall within a normal sleep period were analysed.

Individuals with primary insomnia demonstrated delayed disengagement to the clock ($F(1,84) = 6.9$, $p < 0.05$) which is taken as further support for previous research demonstrating that individuals with primary insomnia exhibit an attentional bias to sleep related stimuli.

These results lend support to the attention–intention–effort model (Espie et al., 2006) and the cognitive model (Harvey, 2002) both of which recognise the importance of selective attention towards salient stimuli in the maintenance of insomnia. Possible clinical implications of attentional bias to sleep as a marker of psychopathology progression and treatment efficacy are discussed.

Introduction

Insomnia

Primary insomnia (PI) is reportedly found in 3% of the population in western industrialised countries (Ohayon, 1996, 2002). According to diagnostic criteria, heightened arousal and learned sleep preventing associations form the foundations of this disorder, with patients exhibiting excessive focus upon and anxiety about sleep (American Sleep Disorder Association, 1997 & 2005, DSM-IV; American Psychiatric Association, 1994). Numerous authors contend that PI is the result of a number of psychological factors, such as maladaptive beliefs about sleep or excessive pre-sleep intrusive thoughts (Harvey, 2002; Espie, 2002; Morin, 1993).

Espie, Broomfield, MacMahon, Macphee, & Taylor (2006) propose a route into PI along the attention–intention–effort pathway which focuses on the inhibition of sleep–wake automaticity. In their conceptual paper, the authors propose that inhibition of sleep–wake automaticity can be attributed to three processes; selectively attending to sleep, explicitly intending to sleep and introducing effort into the sleep engagement process. This model has been developed by drawing on parallels in the anxiety disorder,

* Corresponding author. Department of Psychology, University of Glasgow, Glasgow, Scotland, UK. Tel.: +44 141 330 4757.
E-mail address: heatherw@psy.gla.ac.uk (H. Woods).

0005-7967/$ – see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.brat.2008.12.009

alcohol and drug abuse literature as well as recent clinical and experimental studies on insomnia. The cognitive model of insomnia (Harvey, 2002) likewise highlights the importance of monitoring both internal and external cues in the maintenance of insomnia.

Selective attention to sleep

An attentional bias is said to have developed when the attention system becomes sensitive or selective to a particular theme and impacts on the individual's cognitions. Espie et al. (2006) suggest that the attentional systems of individuals with PI are particularly sensitive to sleep. Several studies have now been carried out establishing a selective attention to sleep in PI using the ICB flicker paradigm and sleep related objects (Marchetti, Biello, Broomfield, MacMahon, & Espie, 2006), using the dot probe task and sleep related words (MacMahon, Broomfield, Macphee, & Espie, 2006) and in a cancer population who have developed sleep onset difficulties (Taylor, Espie, & White, 2003).

Clock monitoring

There is widespread evidence that individuals with insomnia attribute their difficulty with sleep to excessive pre-sleep worry with PI being 10 times more likely to attribute their sleep disturbance to cognitive arousal compared to somatic arousal (Lichstein & Rosenthal, 1980). The items implicating cognition as the major cause of the sleep disturbance (e.g. 'My mind keeps turning things over') on the Sleep Disturbance Questionnaire are the most highly rated (Espie, Brooks, & Lindsay, 1989; Harvey, 2001). Therefore, we find ourselves at the juncture of having established that pre-sleep worry contributes to PI but still unable to identify a trigger for such worry.

From clinical practice it is proposed that PI selectively attend to and monitor for sleep related cues such as body sensations which are consistent or inconsistent with falling asleep and the environment for signs of not falling asleep (Harvey, 2002). One of the sleep related cues associated with the stress of not falling asleep is the bedside clock. Subjective reports highlight two types of clock monitoring in PI; how long the individual has been in bed without sleep and how many hours are left before they have to start their day (Bearpark, 1994; Harvey, 2002). Following from this, Tang, Schmidt, & Harvey (2007) investigated the association between clock monitoring, pre-sleep worry and sleep. Thirty-eight PI were instructed to either monitor a clock or a digital display unit as they were trying to get to sleep. The clock monitoring task was rated as more worry provoking and interfered with sleep more than the digital display monitoring task. The clock monitoring PI reported more pre-sleep worry and longer SOL on the experimental night compared to baseline. Hence, in the clock displaying sleep times, we have an ecologically valid stimulus which is relevant in both the perspective of the patient and clinical research but also within everyday life. Most people would be able to recall at least one occasion where sleep eluded them while being aware the time to rise was approaching.

Cognitive probe task

The aim of this study was to investigate further the role of the clock in the development and maintenance of PI, by bringing together the work discussed above with selective attention in PI and the real life experimental and clinical work carried out previously which provided valuable subjective reports of the impact of the clock and time monitoring on sleep in PI.

Although the paradigms previously used to establish an attentional bias to sleep in PI are recognised as legitimate measures of attentional bias, it was felt that using a modified Posner paradigm would enable a purer measurement of engagement and disengagement to particular cues presented to the participants.

Posner has suggested that the attention system comprises measurable cognitive components (shift, engage, disengage; Posner, 1980), which are subserved by specific, neural sub-systems (Posner & Petersen, 1990) and which are open to modulation by negative emotional stimuli (Stormark, Laberg, Bjerland, Nordby, & Hugdahl 1995). In the original Posner cue-target paradigm, participants responded to a target appearing in the same (valid) or opposite (invalid) location as a previously presented cue. Results indicated faster detection of targets on cued trails, particularly at short ($<$200 ms) cue-target intervals. This facilitation effect was taken as evidence of the time-cost of disengaging attention from the cue to the target on invalid trials (Posner and Petersen, 1990; Posner, 1988). Over recent years, researchers have begun to apply Posner's attention model to develop a paradigm which can determine whether threatening stimuli can attract attention, i.e. modulate the engagement component of covert attention, and/or hold attention, i.e. modulate the disengage component (Broomfield, Gumley, & Espie, 2005).

Methods

Aims and hypotheses

The aim of this study was two-fold. First, by presenting a pictorial representation of an ecologically valid stimulus, to obtain objective evidence of the influence upon attention of monitoring the clock when set at sleep times and therefore the suggestion of the clock and sleep time as a precursor to pre-sleep worry. Second, to explore systematically, with regard to the components of the attentional system, whether participants would take longer to categorise the target on invalid trials with PI having the longest reaction times due to delayed disengagement from this salient cue compared to normal sleepers (NS).

Design

A 2×2 between-participant design was employed for this experiment comparing NS and PI on validly and invalidly cued trials. All subjects recruited completed the computer task followed by the questionnaires detailed below. On completion of these, subjects were preliminarily assigned to either NS or PI group. Thus, it is important to note that the sleep quality for each participant was not known to the experimenter until the computer task was completed as well as any priming effect on the participants being minimised.

Participants

Participants were recruited through advertising online within the University of Glasgow, a poster campaign around the university campus and through advertising on the psychology department's undergraduate student portal for students to obtain course credits. Each individual was given an appointment time to come into the department but was given no further information on the nature of the experiment, other than that it involved a computer based task.

Sleep quality assessment

The sleep quality assessment had three components:

- an interview structured around the ICSD-2 statement of criteria for psychophysiological insomnia and the DSM-IV statement of criteria for primary insomnia;